

# **Key Subsurface Data Integration in Legacy Oil Fields, Northern Shelf, Permian Basin\***

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## **Abstract**

The Permian Basin remains a petroleum-producing jewel in the United States. This is largely due to innovations in thinking, technology, and data integration over the last decade. The fields in this basin have produced for almost 100 years and operators continue to find new plays. However, “Legacy Oil” production has declined by 250,000 bbl/day since 2009 due to a lack of capital for Permian conventional reservoirs or expired mineral rights. Such fields should be re-evaluated for un-exploited potential using modern data integration techniques to include 3D re-processed seismic data for seismic facies interpretation, core data, well log correlations, paleontological reports, mudlogs, and production data. We used this approach to re-evaluate one of Oxy’s legacy oil fields. From this evaluation, we generated a ranked list of prospects, one of which will be drilled in fall 2018.

# Key Subsurface Data Integration in Legacy Oil Fields, Northern Shelf, Permian Basin

*Contributions from David Smith, Mike White, and Duong Nguyen*

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## Shoal Complex

The main feature here, near Eleuthera Island in the Bahamas, is the Schooner Cays shoal complex. The tidal sand ridges, parabolic bars, and intervening channels explode in a blue rhythm. The Bahamas have the third most extensive coral reef in the world.

Landsat 8 data acquired on 04/24/2015

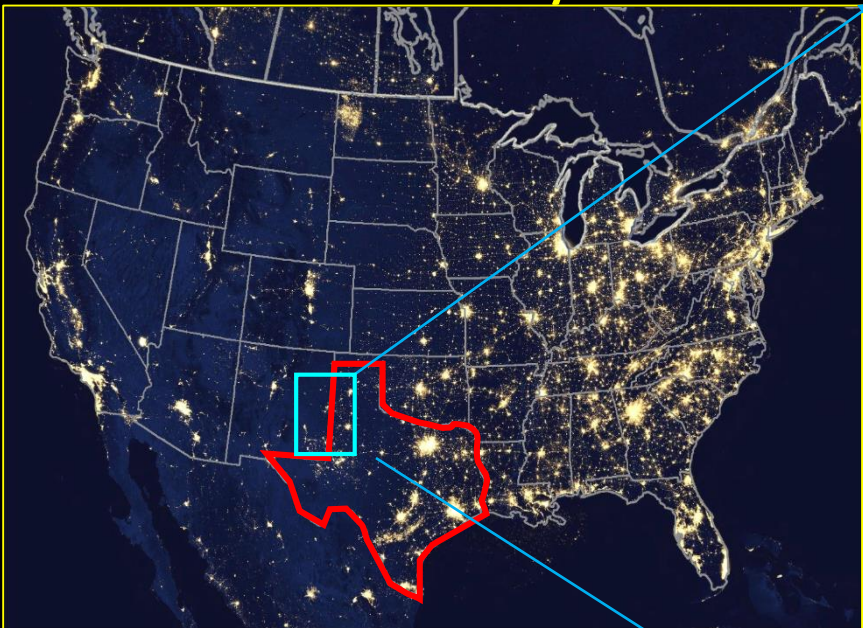
[www.usgs.gov/media/images/shoals-complex](http://www.usgs.gov/media/images/shoals-complex)

# Agenda

- Study Area
- Available Data
- Sub-regional Geology
  - Seismic Data
- Analog Reservoir
  - Core Data
  - Integration
  - Results
  - Summary

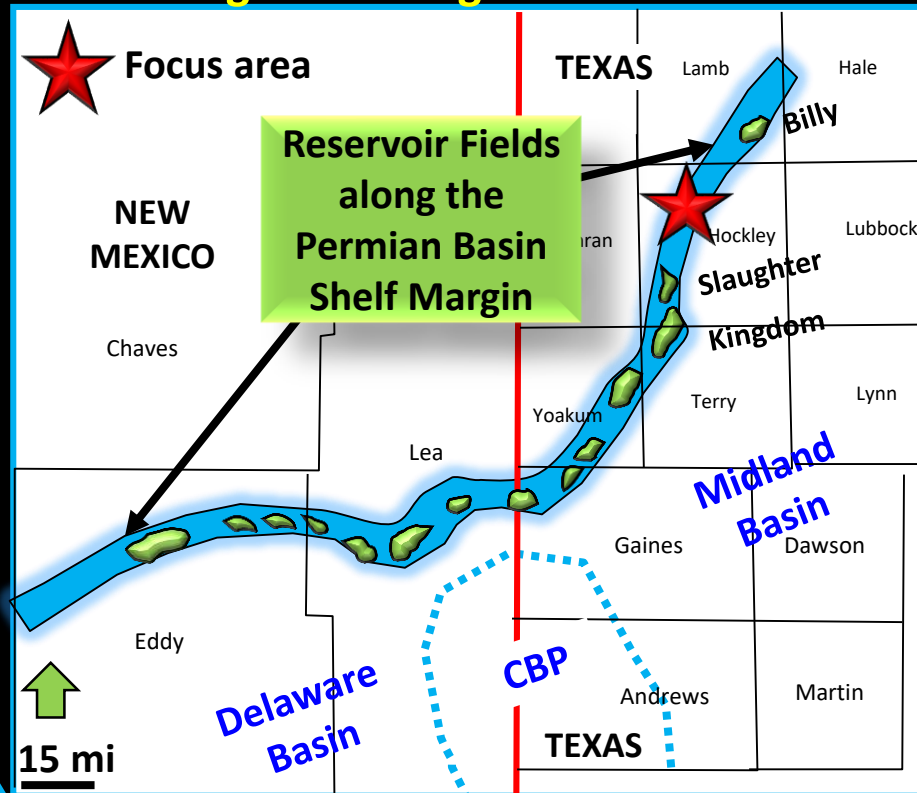
# Background

Satellite Image of US indicating area of study



From www.nasa.gov

Illustration of Abo producing fields along shelf margin and focus area



Modified after D'Agostino, 2002

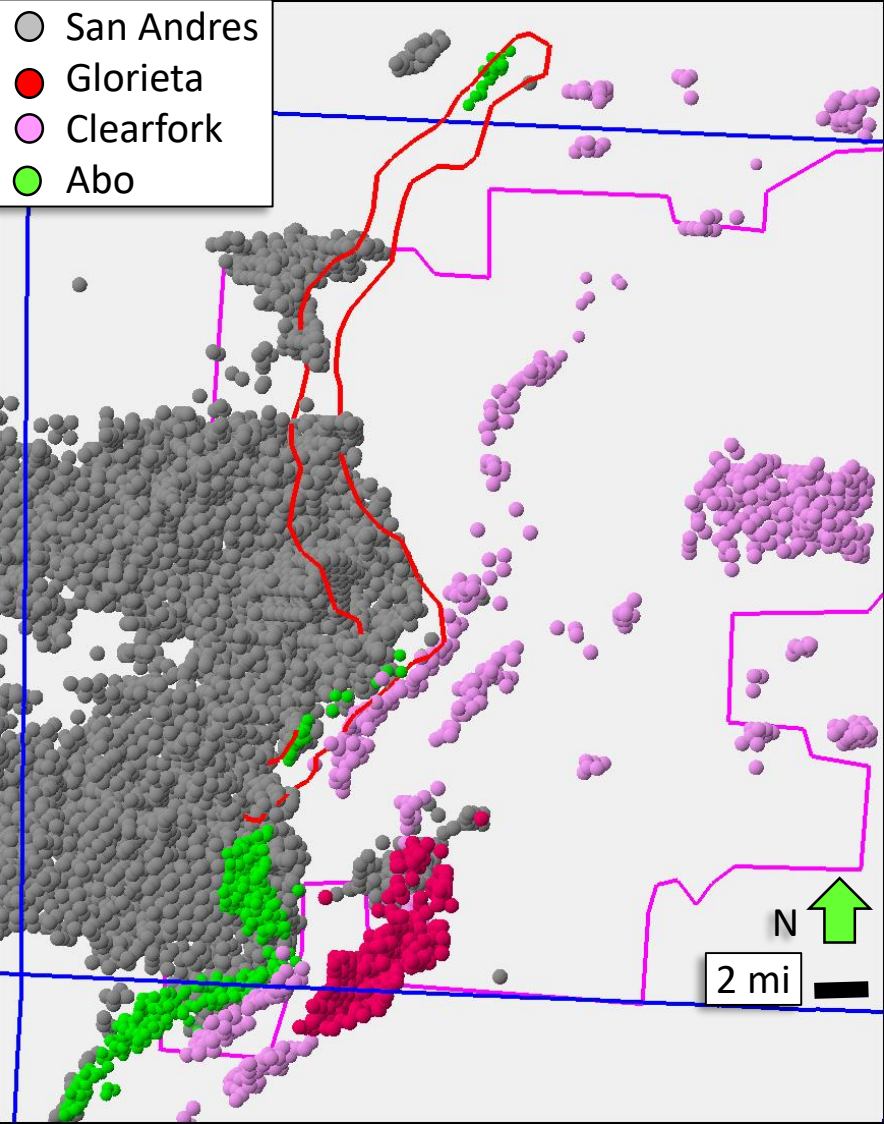
- Tested and produced along the shelf margins surrounding The Permian Basin since 1950s.
- Best 2 producing fields around the Midland Basin are Kingdom and Oxy's Slaughter Consolidated.

Permian Basin Stratigraphic Column

AGE	SERIES	FORMATIONS
P E R M I A N	Ochoan	Rustler
		Salado
	Guadalupian	Tansil
		Yates
		Seven Rivers
		Queen
		Grayburg
		San Andres
	Leonardian	Glorieta
		Upper Clearfork
		Middle Clearfork
		Tubb
		Lower Clearfork
		<b>Abo</b>
WOLFCAMPIAN		Wolfcamp

- The Abo Play is Lower Leonardian in age and possibly charged from Wolfcamp Source Rock.

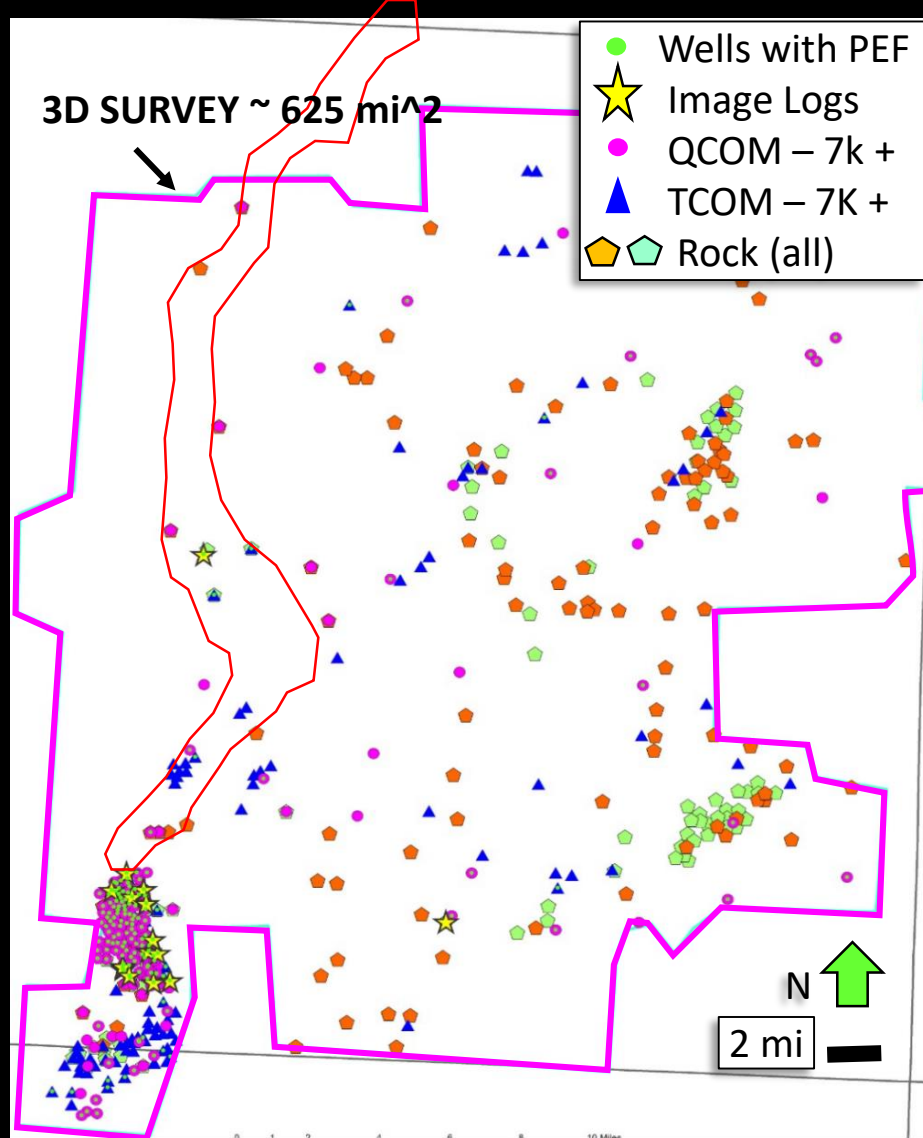
# Available Data



Map Highlighting Producing Formations

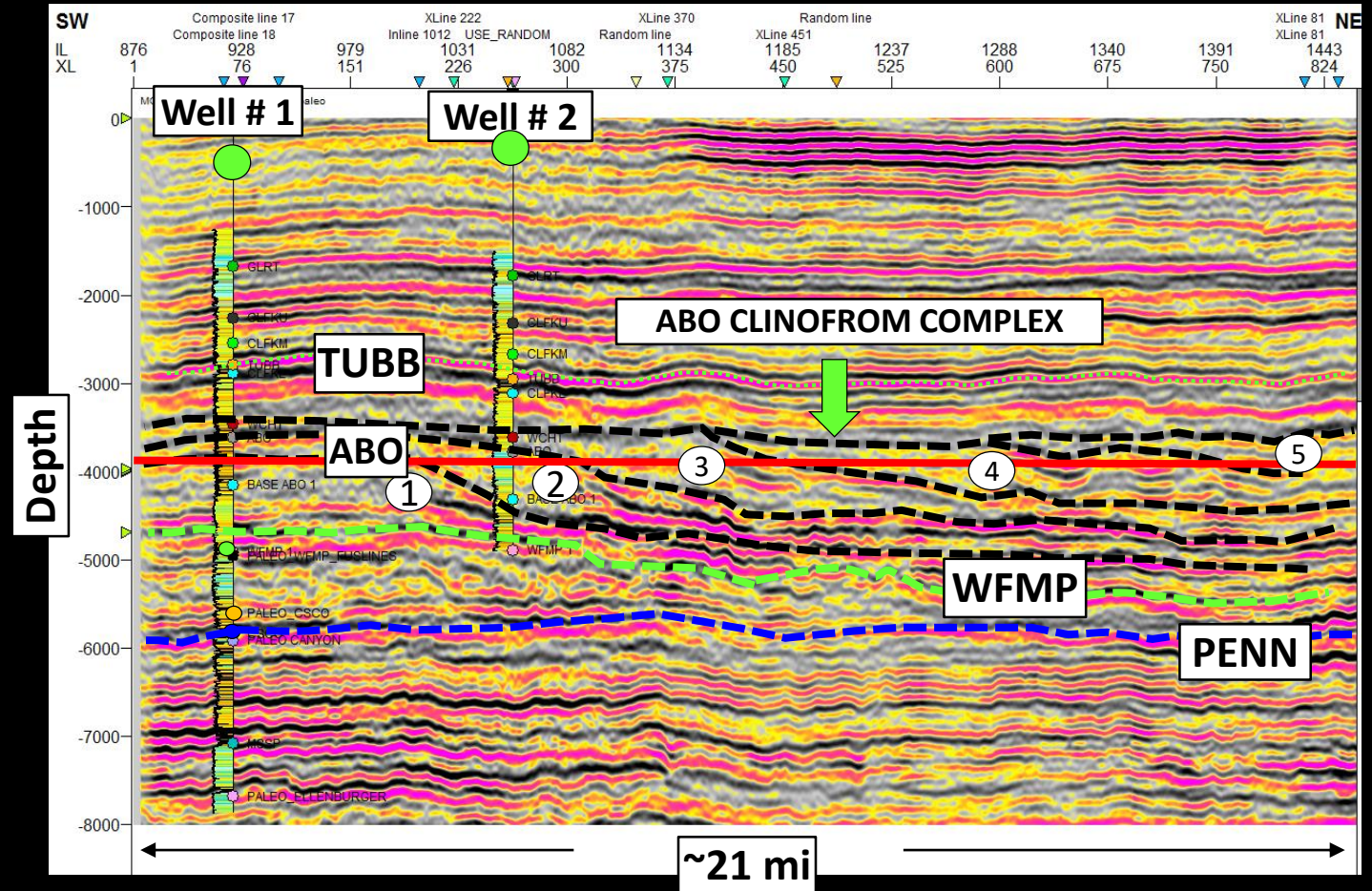
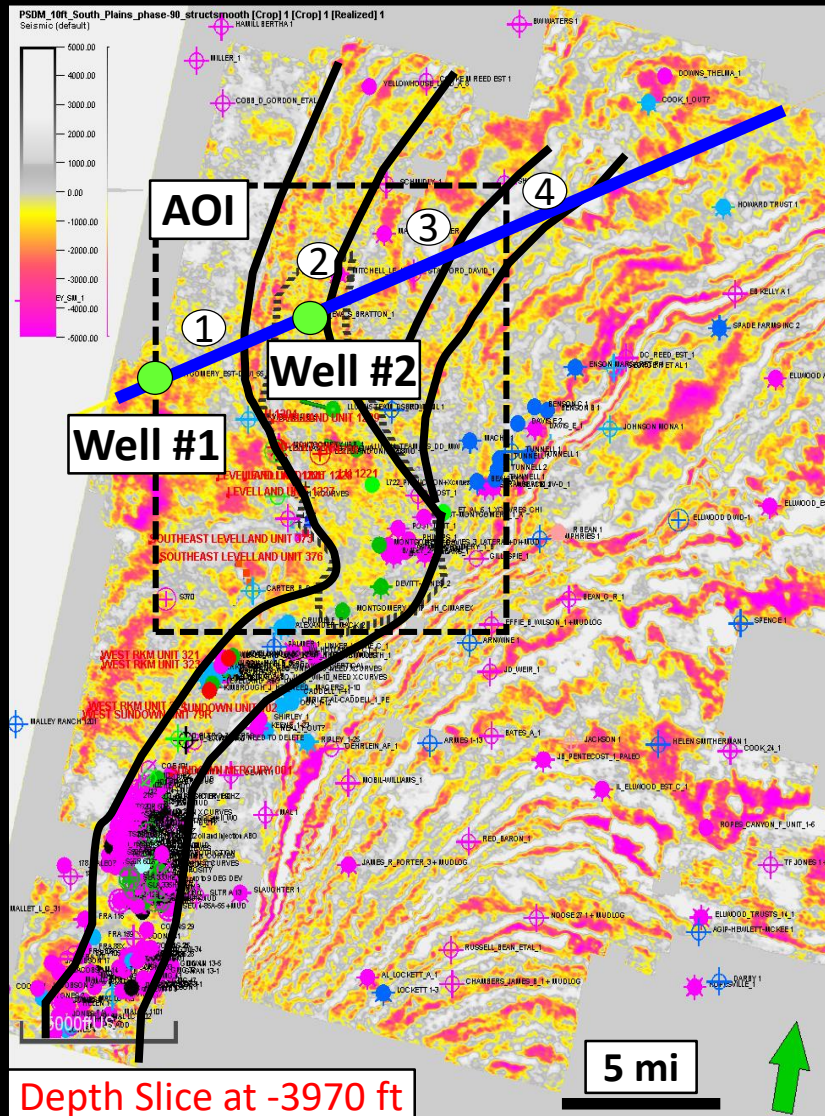
AGE	SERIES	FORMATIONS
P E R M I A N	Ochoan	Rustler Salado
		Tansil Yates Seven Rivers Queen Grayburg San Andres
	Leonardian	Glorieta
		Upper Clearfork
		Middle Clearfork
		Tubb
		Lower Clearfork
		Abo
	Wolfcampian	Wolfcamp

Stratigraphic Chart indicating Producing Formations



Map Illustrating Log and Rock data available

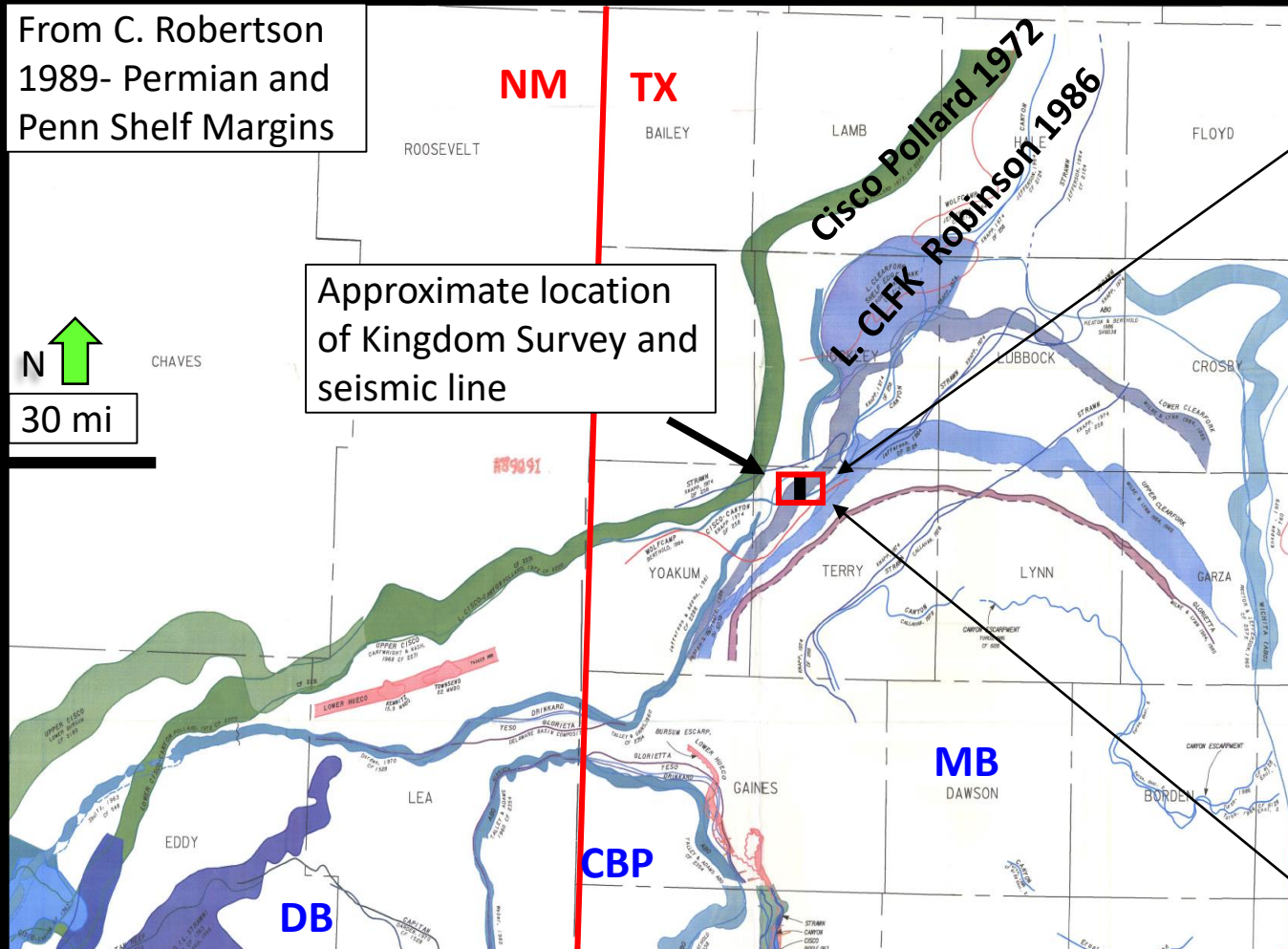
# Abo Shelf-edge Depositional Complex



- The Abo Clinoform Complex is composed of at least 5 depositional sequences (progradational clinoforms).
- ~ 21 miles wide

# Shelf Margins and Abo Depositional Model

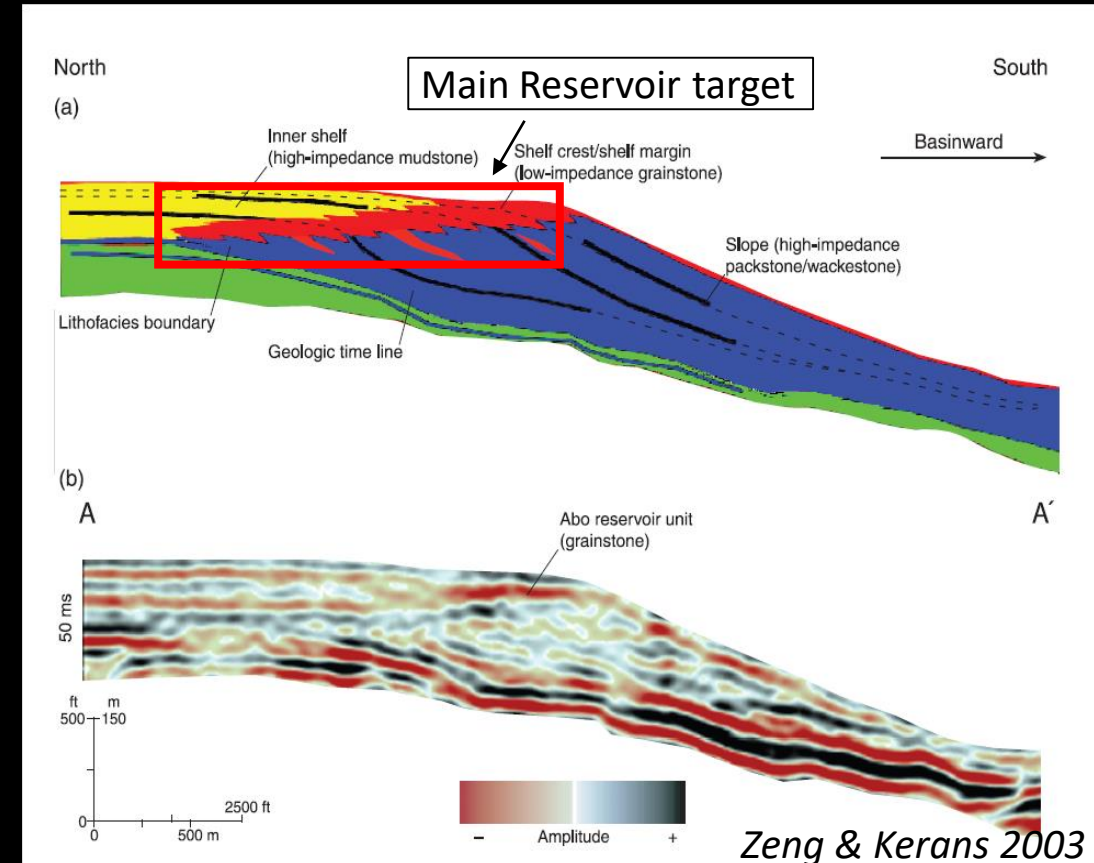
From C. Robertson  
1989- Permian and  
Penn Shelf Margins



- Illustration of a shelf-margin through geologic time.
- Depositional fairways delineation is key for initial scoping.

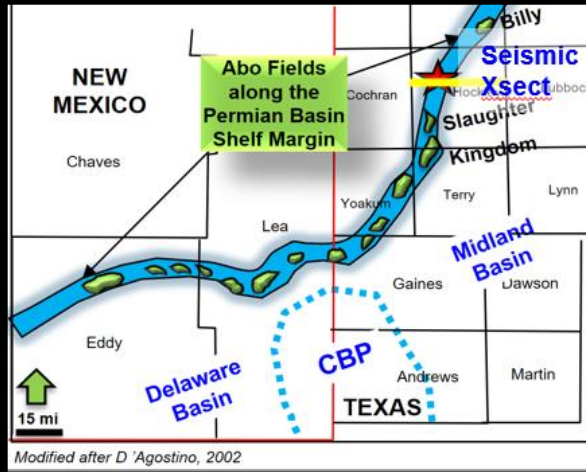
DB = Delaware Basin    CBP= Central Basin Platform    MB= Midland Basin

## Progradational carbonate depositional sequence and seismic response.

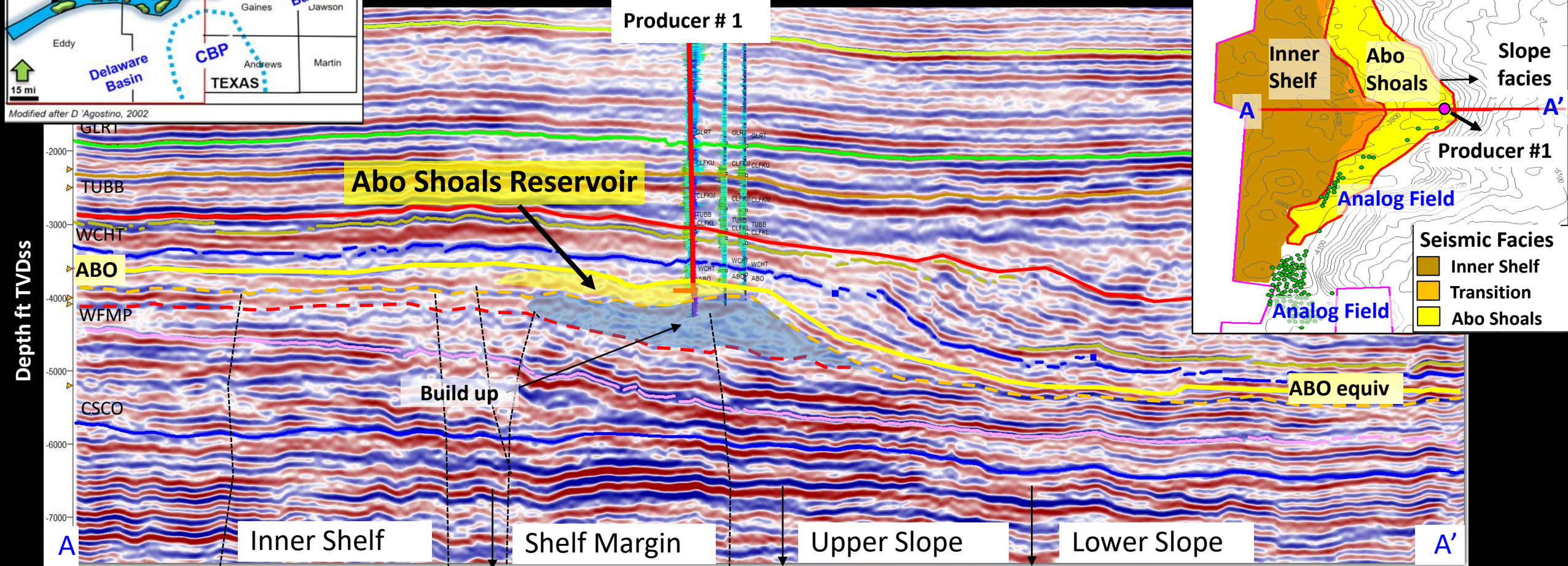


- Case studies from other Abo producing fields were helpful in developing a geologic model in the AOI.

# Seismic Character of Abo Analog Production



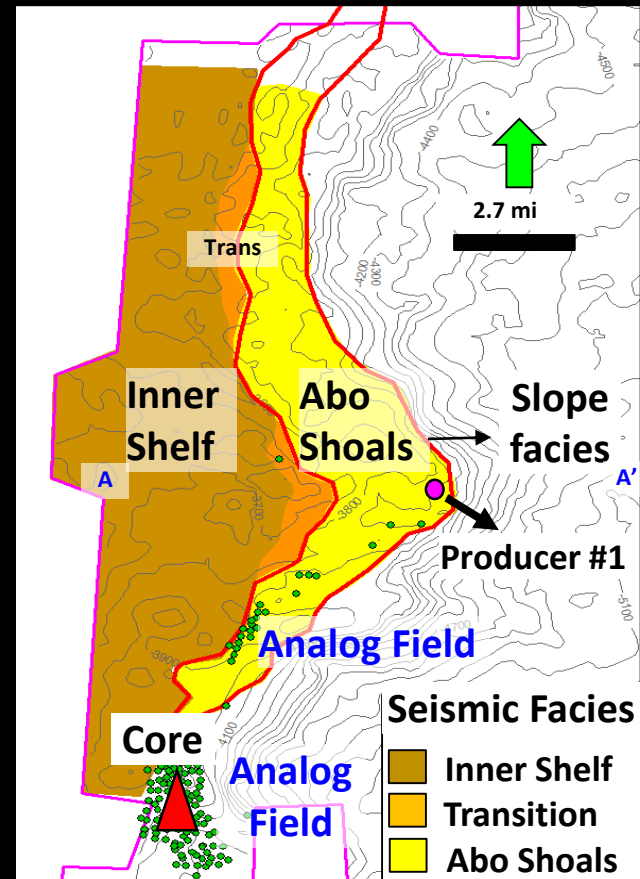
3D Seismic was used to map structure, thickness and seismic facies, and tied to rock and production data for prospecting.



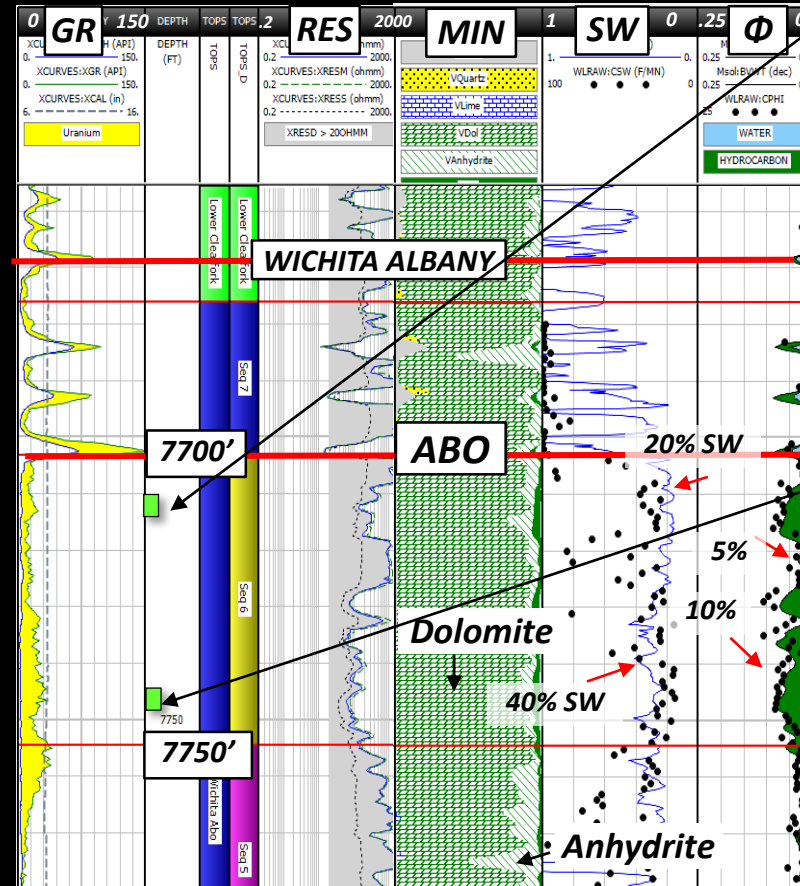
- 3D Seismic line illustrating Structural and Stratigraphic Styles for the Shoal Complex

# Reservoir Analog Target

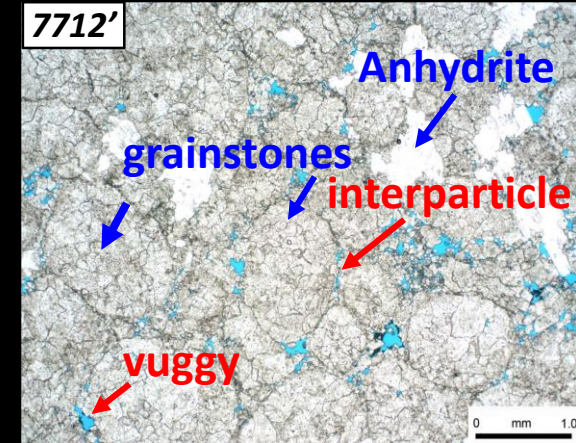
**Map indicating Core Location**



**Well with Core: ~ 14 mi south of AOI**



**Abo grainstone facies**

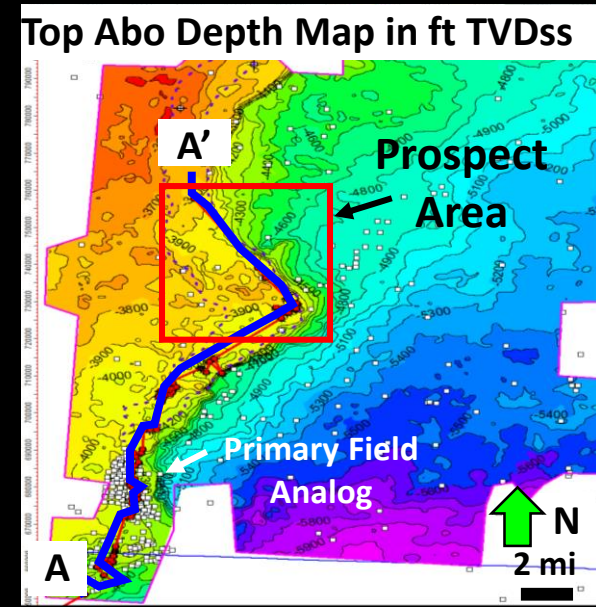


- Grainstones encountered in analog fields.
- Primary Target reservoir in AOI.

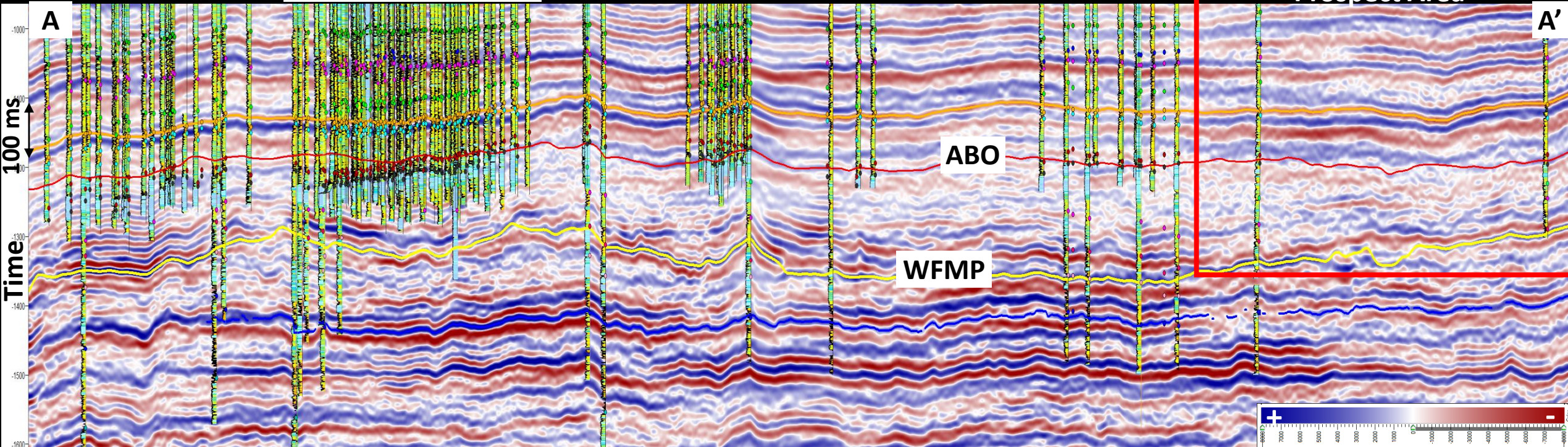
- Oil saturated grainstones are a producing target in analog field.
- Pursuing same target to the North. We see continuity of reservoir presence based on seismic data and well logs.

# Seismic Line Parallel to Shelf Edge

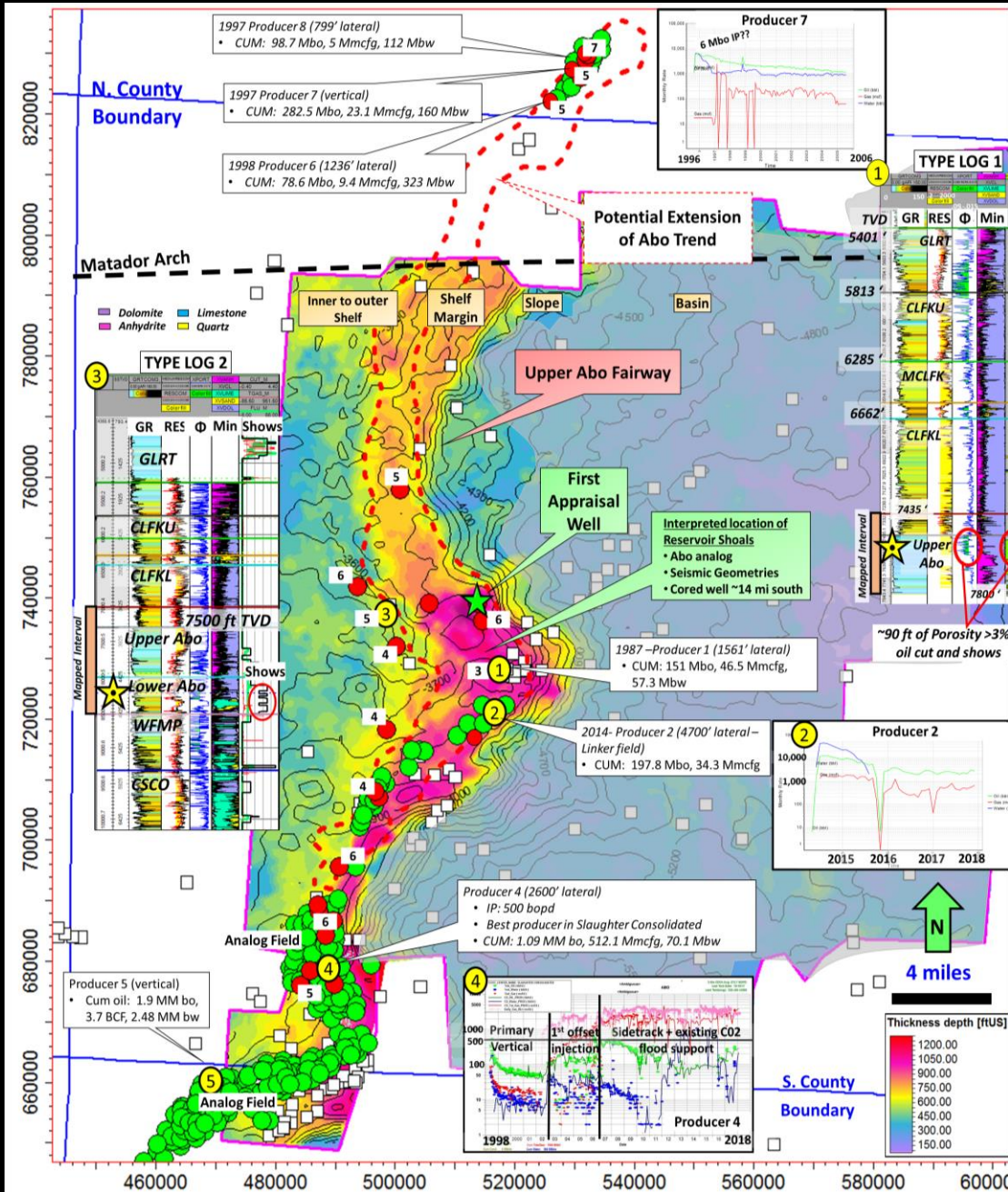
- Abo top shows good seismic continuity.
  - Internal seismic character challenging to map.
- Several well penetrations in the southern part of the trend.
- Lack of deep well control along Abo trend.



Primary Field Analog



# Abo Play Map



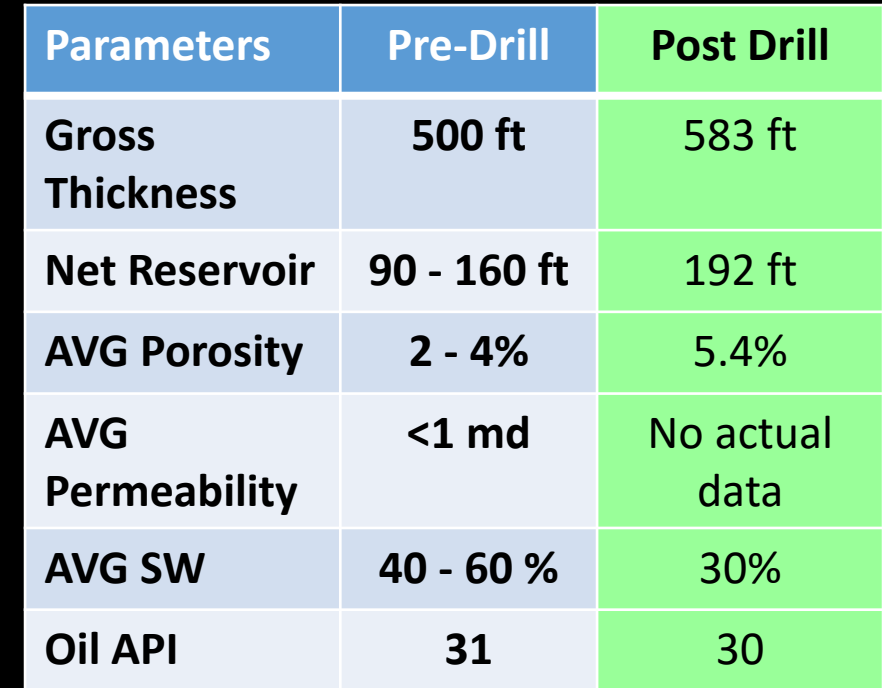
-  Producers
-  Petrophysical Data
-  Wells with Total PHIT
-  Control Points
-  Drilled Prospect
-  Mapped Trend

 Mapped Trend

## Reservoir Trend Map



### Table comparing pre and post drill prognosis



- Geologic success.
- Still assessing play potential.

# Summary

- Platform areas that were discovered in the 1950's have been heavily drilled.
  - Integration of all available data including modern seismic should be re-evaluated and it may unveil additional reservoir potential.
- Understanding the regional to sub-regional picture and integrating geoscience and engineering data calibrated with production is key for prospecting.
- It is essential to do field analog studies and understand why they were developed in a specific manner to understand lessons learned and allow for optimized future development.
- All disciplines must work together in performing an integrated evaluation to achieve optimal results.

